REMARKS

Claims 1-9, 12-15, 17-30, 33, 38, 39, 42, 49-55, and 57-65 will be pending upon entry of the present amendment. Claims 1-5, 7, 9, 12, 14, 15, 17, 18, 26, 28, 29, 33, 38, 39, and 55 are amended, claims 10, 16, and 56 are canceled, and new claims 57-65 are submitted herewith. No new matter has been added to the application.

Applicants thank the Examiner for indicating the allowability of claims 18-25, and of the subject matter of claim 4.

The specification has been amended by a correction to a description of a prior art reference in the background section of the specification, and by the addition of two paragraphs to the detailed description, in which the term *active tension* is introduced and defined. While the Applicants believe that the term *tension*, as used in the claims as originally filed, is distinguishable from the prior art, in particular with regard to the Sato reference, Applicants also recognize the potential for confusion and unintentional conflation of different principles of operation. Accordingly, many of the claims have been amended to recite *active tension*, to clearly distinguish them from the Sato reference. Applicants thank Examiner Beck for his consideration in taking the time, in a brief telephone interview with the undersigned representative on February 25, 2008, to discuss the language of the added paragraphs, and for agreeing that, on the basis of his initial review, they do not constitute new matter.

Some of the amended and new claims incorporate previously unclaimed subject matter from the specification. Claims 1, 14, 26, 28, and 61 recite *force response*. Support for this term can be found in the specification, in particular, beginning at page 27, line 12 and extending through page 28, line 22.

Claim 5 recites "a sensor configured to sense, independent of the first tool translation effecter device, a position of the attachment point relative to the first tool translation effecter device." Support for this limitation can be found in the specification beginning at page 26, line 26. The amendment to claim 33 is also supported by this portion of the specification.

New claim 58 recites, "a calibration point at which the attachment point can be positioned, and from which the respective distances between each of the first, second, third, and

fourth tool translation effecter devices and the attachment point are known." Support for claim 58, and also for claim 60 can be found in the specification in the paragraph beginning at page 26, line 18.

Claims 34-37, canceled in Applicants' response to the previous Final Office Action, have been resubmitted as new claims 62-65. The allowability of claims 62-65 will be addressed below with respect to the rejection of claims 34-38 as set forth in the Office Action of August 22, 2007. Claim 62 recites, in part, "tracking a distance of the tool from the anchor point …; and limiting tracking errors introduced by changes in effective diameter of the spool …." The underlined text replaces the text "compensating for," as recited in original Claim 34. Support for this language can be found in the specification beginning at page 25, line 20, and extending at least to page 27, line 11. In particular, this portion of the specification discusses the potential for introduction of error because of changes in effective dimensions of the spool, and various approaches to address the issue. The methods disclosed do not merely compensate for tracking error, but can be used to more correctly interpret the amount of change in cable length per encoder pulse at any given overall length, and that overall tracking can be selected to be more accurate or less accurate. Thus, *limiting tracking errors* is an appropriate term for claiming operations that produce the described results.

Claims 55 and 56 are objected to as depending from canceled claims 34 and 35, respectively. Claim 55 is amended to depend from new claim 62, and claim 56 is canceled.

Claim 39 is objected to as lacking antecedent basis for "the measuring rotation step," and has therefore been amended to recite "measuring rotation of the tool …."

Claims 29, 30, and 33 are rejected under 35 U.S.C. § 112, first paragraph, as failing to comply with the written description requirement. In particular, the Examiner cites *In re Mayhew* (527 F.2d 1229, 188 U.S.P.Q. 356 (1976)), arguing that establishing an initial value of the cable lengths is critical and essential for the purpose of measuring a change of cable length from a starting position, and that the claim as presented is not enabled by the specification.

Claim 29 has been amended to separate one of its limitations into separate limitations, and now recites, separately, "establishing an initial length of cable …" and "locking, during a shutdown procedure …." While this amendment resolves the immediate rejection,

Applicants respectfully disagree with the Examiner's application of *Mayhew* to the claims of the present application. In his rejection, the *Mayhew* Examiner argues that "there is only one mode supported by the specification disclosure," and that the disclosure is insufficient "since applicant has disclosed that [described cooling steps] are essential steps in his inventive process." *Id*, at 1232. In agreeing with the Examiner, the court recognizes that the process steps in question are not taught in the prior art, and that "[a]lthough appellant now strenuously argues that the cooling bath is optional, his specification not only fails to support this contention, but leads us, as it did the examiner and board, to believe that both it and its location are essential." *Id*, at 1233.

The present application can be distinguished from *Mayhew* in several important respects. First, the general concept of establishing an initial length of cable is known in the art (see *Sato*, column 4, line 22). Second, the present specification is not limited to a single mode of operation, but discloses a number of embodiments, employing various modes of operation. See, for example, the embodiments described beginning at page 17, line 19; page 19, line 8; page 20, line 11; page 23, line 6; page 26, line 26; etc. Third, while each embodiment describes specific acts comprised by that embodiment, none of these descriptions indicate nor suggest that there is any single act that is essential to the practice of every embodiment. Finally, the specification suggests alternative tracking methods, including infrared, electromagnetic, gyroscopic, or acceleration based sensors (see page 26, line 26 through page 27, line 11). While the specification does not attempt to provide an analysis of the effectiveness of these alternative methods, it clearly contemplates the possibility that they could be used independent of cable length to track the position of the tool, and from which cable lengths could be subsequently derived (see page 27, lines 4-6).

For the reasons outlined above, there are no elements or process acts disclosed in the specification as being essential to the claims or that without which the claims would be unsupported by the specification.

Summary of Rejections Under 35 U.S.C. §§ 102 and 103

Claims 1, 3, 5, 6, 10, 29, 30, and 33, are rejected under 35 U.S.C. §103(a) as being unpatentable over Sato et al. (U.S. Patent 5,305,429, hereafter *Sato*) in view of Matsumoto (U.S.

Patent 6,587,749); claims 9, 12-14, 16, 17, 26-28, 38, 39, 42, 49, 51, 52, and 54 are rejected under 35 U.S.C. §103(a) as being unpatentable over Sato in view of Stork et al. (U.S Patent 6,104,380 hereafter *Stork*); claims 50 and 53 are rejected under 35 U.S.C. §103(a) as being unpatentable over Sato and Stork in view of Matsumoto; claim 15 is rejected under 35 U.S.C. §103(a) as being unpatentable over Sato and Stork in view of Lefkowitz et al. (U.S. Patent 5,440,476, hereafter Lefkowitz); claim 2 is rejected under 35 U.S.C. §103(a) as being unpatentable over Sato and Lefkowitz in view of Kim et al., ("Design of Tension Based Haptic Interface: SPIDAR G," hereafter *Kim*); and claims 7 and 8 are rejected under 35 U.S.C. §103(a) as being unpatentable over Sato and Matsumoto in view of Stork. Claims 62-65 (previously claims 34-37) were rejected in the Office Action of August 22, 2007, under 35 U.S.C. §103(a) as being unpatentable over Kim in view of Lefkowitz.

In the discussion that follows, when a specific passage of a U.S. patent is cited, it will be indicated by a column number separated from a line number by a colon, e.g., 4:22, indicating column 4, line 22.

Claim 1 recites, in part:

> each tool translation effecter device including controlling means for selectively varying an active tension on the respective cable; … and calculating means for calculating a force response to be applied to the attachment point at least in part on the basis of a position of the attachment point, as determined by a distance between each of the first, second, third, and fourth tool translation effecter devices and the attachment point."

Sato fails to teach or suggest these limitations of claim 1. In particular, Sato teaches a balanced system such that, if the operator's finger is removed from the instruction point, at any location, it remains stably held in that position (3:38-45, 4:2-5). Sato cannot selectively vary an active tension applied to each line, but can only vary an amount of resistance to movement of the line. It cannot be argued that by applying a clamp to its line, Sato varies an active tension applied by the weight at the end of that line, because the drag applied is bidirectional, meaning that it applies exactly as much resistance to movement in one direction as it does in the other, and the longitudinal force that was on the line before the clamp applies remains unchanged. If Sato's system were standing without an operator in contact with the instruction point, it would be impossible for the system, by selectively varying the drag applied

to the lines, to cause the instruction point to move in response to the variations in drag on the lines. Therefore, Sato does not selectively vary active tension, nor can it apply a *force response* to its instruction point. For its part, Matsumoto is entirely silent regarding haptic systems. Matsumoto apparently employs a simple control unit 15 (Figure 2) for user manipulation, and cannot teach the missing elements.

Furthermore, even if there were a reference that in combination with Sato could teach all the limitations of claim 1, such a combination would be inappropriate. Sato's principle of operation is based on a balanced system that operates by applying drag to its lines to apply more or less resistance to force *applied by the operator* at the instruction point. Combination with another reference capable of selectively varying an active tension on its lines would fundamentally change Sato's principle of operation, and would therefore be insufficient to render the claim prima facie obvious. (See MPEP§ 2143.01, subsection VI ([i]f the proposed modification or combination of the prior art would change the principle of operation of the prior art invention being modified, then the teachings of the references are not sufficient to render the claims *prima facie* obvious.))

Dependent claim 3 recites, "a controller configured to direct the first tool translation effecter device to retract, during an initialization procedure, the first cable until the attachment point is at a selected position relative to the first tool translation effecter device." The Examiner points to elements of Sato's relay 44 as corresponding to the tool translation effecter device of claim 3. Applicants respectfully disagree. To the extent that Sato's relays apply any force to its lines, the force is perpendicular to the lines, and has no effect with respect to longitudinal forces on its lines. As discussed above, if no operator is in contact with Sato's device, it cannot itself initiate any kind of movement of its instruction point. Gripping or releasing the relays on any or all of Sato's lines will not make the instruction point move. Thus, Sato's system is incapable of directing one of its relays to retract a line, under any circumstances, as would be necessary to teach the limitation of the claim. Accordingly, Sato fails to teach the limitation of claim 3, which is therefore allowable on its own merits.

Claim 29 recites, in part, "applying a selectively variable active tension to each of a plurality of cables … storing, after the locking and before completing the shutdown procedure,

a value indicative of a known length of each of the cables in a memory; and recovering the value … from the memory during a startup procedure." A combination of Sato with Matsumoto cannot teach or suggest all the limitations of claim 29. The deficiency of Sato and Matsumoto with regard to applying a selectively variable active tension has been discussed above, and need not be repeated, but these references fail in other respects, as well. The Examiner points to *Sato* 4:22-27, which states that "*by giving an initial value of the length* … and, further, by accumulating and adding the amounts of change, the length … can be measured in a real time manner," and argues that this text inherently suggests that "an initial value is needed immediately after a startup procedure once the interface device is turned on …," and that "this initial value must be stored in a memory at all times, including at times during a shutdown procedure, such that it may be recovered during the startup procedure …." Applicants strongly disagree. The MPEP discusses an Examiner's burden with regard to a showing of inherency, as outlined in relevant part below.

> The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic…. To establish inherency, the extrinsic evidence must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient….
>
> In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the allegedly inherent characteristic necessarily flows from the teachings of the applied prior art. (MPEP § 2112 at IV; citations omitted, emphasis in the original.)

The Applicants do not believe that the quoted limitations of claim 29 are inherently taught by Sato. The Examiner argues inherency on the basis of one very short phrase: "*by giving an initial value of the length* …." There is nothing in this text that would rule out something as simple as an operator manually measuring each line and entering the respective values in order to "[give] an initial value of the length …." The text does not require that the initial value be in the system when it is turned on. It does not require that the system itself derive the value through some initialization procedure. It only indicates that the value must be given by

someone or something, initially. Because there are a number of reasonable ways to give an initial value, no single one of them "necessarily flows from the teachings" of Sato, as would be necessary to support inherency.

Most telling, the storing and retrieving of such data can only have value if it can be guaranteed that the instruction point will not move between the time the system is shut down and when it is restarted. The Examiner acknowledges that Sato does not provide any teaching of locking its lines during shutdown, but without such a teaching *by Sato*, saving and retrieving line lengths is useless. If Sato itself does not lock its cables, it cannot prevent its instruction point from moving while it is shut down. Thus, even if it did hold a value indicative of a known length of its cables in a memory while being shut down, once restarted, it would be impossible to determine whether the stored values were still valid without actually reentering correct values for comparison, which would, of course, defeat the purpose of storing them in the first place. Whether or not Matsumoto suggests locking Sato's lines during shutdown is irrelevant to the question of inherency. "Inherency … may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient…." (See quote from the MPEP, above.)

In the absence of an inherent teaching, Sato fails to teach or suggest "storing, after the locking step and before completing the shutdown procedure, a value indicative of the known length of each of the cables in a memory," and in the absence of a teaching of "locking … each of the plurality of cables at the respective anchor point," Sato cannot provide the inherent teaching, and cannot offer any benefit or advantage such as would make it "obvious to try" to store the values during a shutdown procedure.

For its part, Matsumoto is directed to a system that offers a simplified method of changing a robot's position *while its controller is shut down* (e.g., 3:15-18 and 4:48-65). Matsumoto specifically provides for moving the robot during times when it would be impossible to track the movement, making stored data useless. Thus, while Matsumoto's robot engages brakes upon shutting down, this is not for the purpose of permitting the use of previously stored positional data upon restarting, but for other reasons, probably related to safety in the industrial environments where such robots are used. Accordingly, Matsumoto also fails to teach or suggest

"storing, after the locking and before completing the shutdown procedure, a value indicative of the known length of each of the cables in a memory," and also fails to offer any suggestion that storing such data would provide any benefit.

For at least the reasons outlined above, a combination of Matsumoto with Sato fails to teach or suggest all the limitations of claim 29, which is therefore allowable.

Claim 9 recites, in part, "each tool translation effecter device configured to selectively vary an active tension on the cable coupled thereto and to meter the cable as it is retracted and paid out." Because Sato's relays 44 can only resist movement, and its weights 40 can only exert a fixed tension, Sato fails to teach or suggest a device configured to *selectively vary an active tension* on the cable. For its part, Stork teaches a wireless input device for control of on-screen presentations, etc. (see, e.g., 2:66-67, 3:12-15, 3:43-45, 5:1-14). While Stork also teaches a "touch-sensitive input device" (4:39-42, 5:1-14) this is in the form of an LCD screen or the like, and is also unrelated to haptic-type systems, and is thus nonanalogous. Stork is entirely silent regarding cables, let alone tension of any kind applied to cables. Accordingly, it cannot offer any teaching related to the quoted limitation of claim 9. Thus, a combination of Stork with Sato fails to teach or suggest all the limitations of claim 9, which is therefore allowable.

Claim 12 recites, in part, "each of the motors operable to drive the respective spool to selectively apply active tension to the respective cable." Neither Stork nor Sato teach or suggest this limitation of claim 12, which is therefore allowable.

Claim 38 recites, in part, "selectively applying active tension to each of four cables." Stork and Sato cannot teach or suggest this limitation of claim 38, either individually or in combination. Accordingly, claim 38 is allowable thereover.

For the Examiner's convenience, claim 62 is provided below with redlining to show changes made, as compared to previously canceled claim 34.

> 62. A method, comprising:
>
> selectively applying active tension to a cable having a first end and a second ends, the first end of the cable coupled to a tool and the second end of the cable coupled to an anchor point;

as the tool is moved closer to the anchor point, winding the cable onto a spool;

as the tool is moved away from the anchor point unwinding the cable from the spool;

tracking a distance of the tool from the anchor point by counting fractional rotations of the spool as the cable is wound and unwound therefrom; and

~~compensating for~~ limiting tracking errors introduced by changes in effective diameter of the spool as the effective diameter changes in response to the cable being wound and unwound therefrom.

In rejecting claim 34, the Examiner relied on Lefkowitz (in combination with Kim) to teach limitations related to compensating for a change in the effective diameter of the spool as cable is wound and unwound. Lefkowitz states that:

> the diameter of the spool may change as cable is taken up or released, thereby changing the speed of cable take up and release, even though motor speed is kept constant. To compensate for this effect and maintain a constant take up and release speed, compensating means are provided for adjusting the spool motor speed as the spool diameter changes. *Lefkowitz*, 4:12-17.

As can be seen, Lefkowitz suggests compensating for changes in *speed*, and does not teach "limiting tracking errors introduced by changes in effective diameter," as currently recited in claim 62. The passage quoted above is the only statement Lefkowitz makes with regard to compensating for changes in spool diameter, because its preferred embodiment employs a pulley, regarding which it states, "[t]his yields a constant-diameter spool, thereby eliminating the need for the compensating means mentioned."

Lefkowitz provides no teaching as to how to compensate, either for speed or tracking error, but merely makes a single reference to the problem, and proceeds to introduce a preferred embodiment that does not suffer from the problem.

With regard to prior art relied upon to reject a claim, the MPEP states that "[t]he disclosure in an assertedly anticipating reference must provide an enabling disclosure of the

desired subject matter; *mere naming or description of the subject matter is insufficient*, if it cannot be produced without undue experimentation." MPEP § 2121.1 (emphasis added).

Whether Lefkowitz enables compensating for speed is not certain, nor is it important here. What is clear is that Lefkowitz does not enable "limiting tracking errors" as recited in claim 62. The possible solutions to these two problems are not identical, nor are they simple in nature. Neither Lefkowitz, nor Kim, nor any other art of record even suggests an approach to solving the problem, let alone an actual solution. Without such a solution, Lefkowitz cannot provide an enabling disclosure, and therefore cannot be relied upon to teach the limitation. Accordingly, claim 62 is allowable over a combination of Lefkowitz and Kim.

Claim 64 recites that the "number of cables in the plurality of cables is equal to three," and claim 65 recites that the "number of cables in the plurality of cables is equal to four." Kim teaches a device that employs eight cables (see, e.g., Figure 3), and therefore fails to teach or suggest either of claims 64 or 65.

With regard to the rejections of claims 2 and 15, applicant notes that Sato, cited in the rejection of each, does not wrap cables over a spool, but instead, like Lefkowitz's preferred embodiment, uses a pulley system that does not experience changes in effective diameter, or require any correction. There is therefore no motivation to try, either in the teachings of the references, or on the basis of the common sense of one of ordinary skill. Accordingly, claims 2 and 15 are also allowable on their own merits.

Conclusion

Overall, the cited references do not singly, or in any motivated combination, teach or suggest the claimed features of the embodiments recited in independent claims 1, 9, 12, 18, 29, 38, or 62, and thus such claims are allowable. Applicants' decision not to argue the allowability of each of the dependent claims is not to be construed as an admission that such claims would not be allowable but for their dependence on allowable base claims. If the undersigned representative has overlooked a relevant teaching in any of the references, the Examiner is requested to point out specifically where such teaching may be found.

In light of the above amendments and remarks, Applicants respectfully submits that all pending claims are allowable, and therefore request that the Examiner reconsider this application and timely allow all pending claims. Examiner Beck is encouraged to contact Mr. Bennett by telephone at (206) 694-4848 to discuss the above and any other distinctions between the claims and the applied references, and to address any informalities that may remain unresolved.

The Director is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

Respectfully submitted,

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